



Contribution ID: 128

Type: **not specified**

Electroluminescence studies for CYGNO - Directional Dark Matter search with an optical TPC

Thursday, March 18, 2021 3:40 PM (20 minutes)

CYGNO (a CYGNus TPC with Optical readout) is a gaseous TPC Dark Matter directional experiment, to be hosted at Laboratori Nazionali del Gran Sasso, Italy. It fits into the context of the wider CYGNUS international proto-collaboration, for the development of a Galactic Nuclear Recoil Observatory at the ton-scale with directional sensitivity, having as the main goal the probing of the DM hypothesis below the Neutrino Floor and perform Solar Neutrino Physics.

In the CYGNO-TPC, the output signal results from the electroluminescence produced in the avalanches which develop in the strong electric fields inside the holes of the micropattern-type structures used for charge multiplication, and is collected by suitable photosensors. For the purpose of the experiment, the best gas and gas mixtures are being optimized, aiming at best performance in terms of the most relevant parameters, including identification of nuclear recoils and their direction.

We will present results for electroluminescence yield, charge gain and energy resolution for several gas mixtures of interest to the CYGNO project, namely He-CF₄ mixtures and He-CF₄-isobutane mixtures. The measurements were performed in a gaseous detector, equipped with a GEM for charge multiplication of the ionization signal and a Large Area Avalanche Photodiode to readout the electroluminescence produced in the electron avalanches.

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Session Classification: Gaseous Detectors

Track Classification: Gaseous Detectors